FARM BULLETIN NO. 13

BEE-KEEPING for beginners

INDIAN COUNCIL OF AGRICULTURAL RESEARCH
NEW DELHI

This is the thirteenth of a series of bulletins planned by the Indian Council of Agricultural Research to meet the paucity of literature in a simple, yet authoritative form and dealing with farming and animal husbandry subjects. Each of the Bulletins is so written as to give a general picture of farming practices in vogue in the country, and suggest improvements based on research results. The Bulletins, it is hoped, will be found useful by the farmer, the agricultural student and the Extension worker alike.

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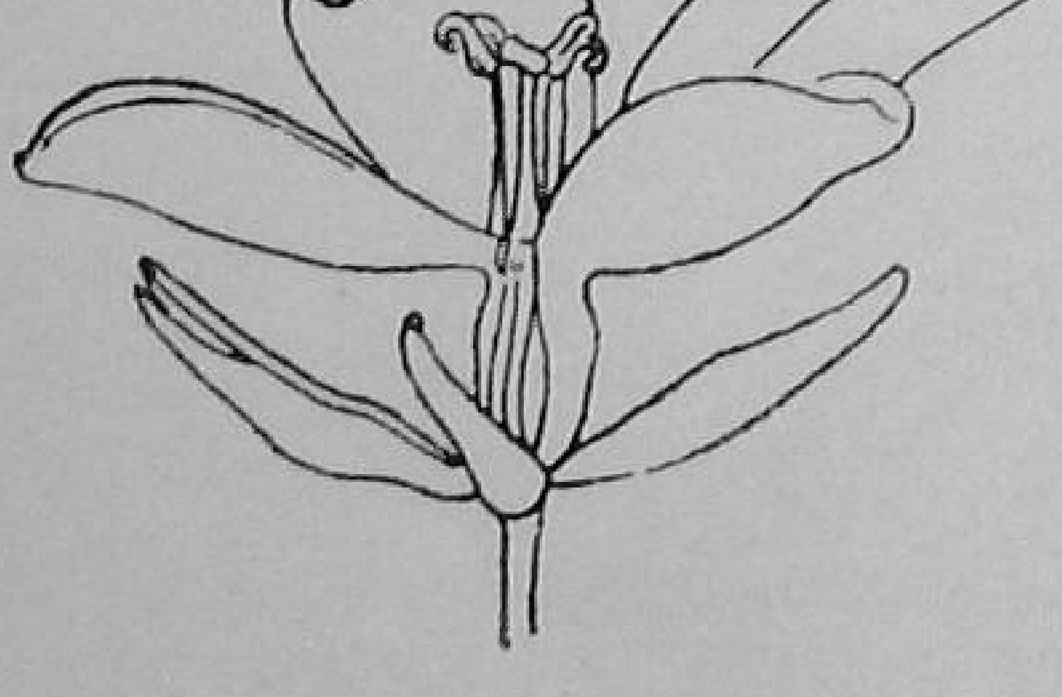
BEE-KEEPING IN INDIA

THE honey-bee, known to man since the earliest times, produces honey, a food of high nutritive and medicinal value It also produces beeswax which finds many uses in industry, such as in the preparation of cosmetics and polishes of various kinds.

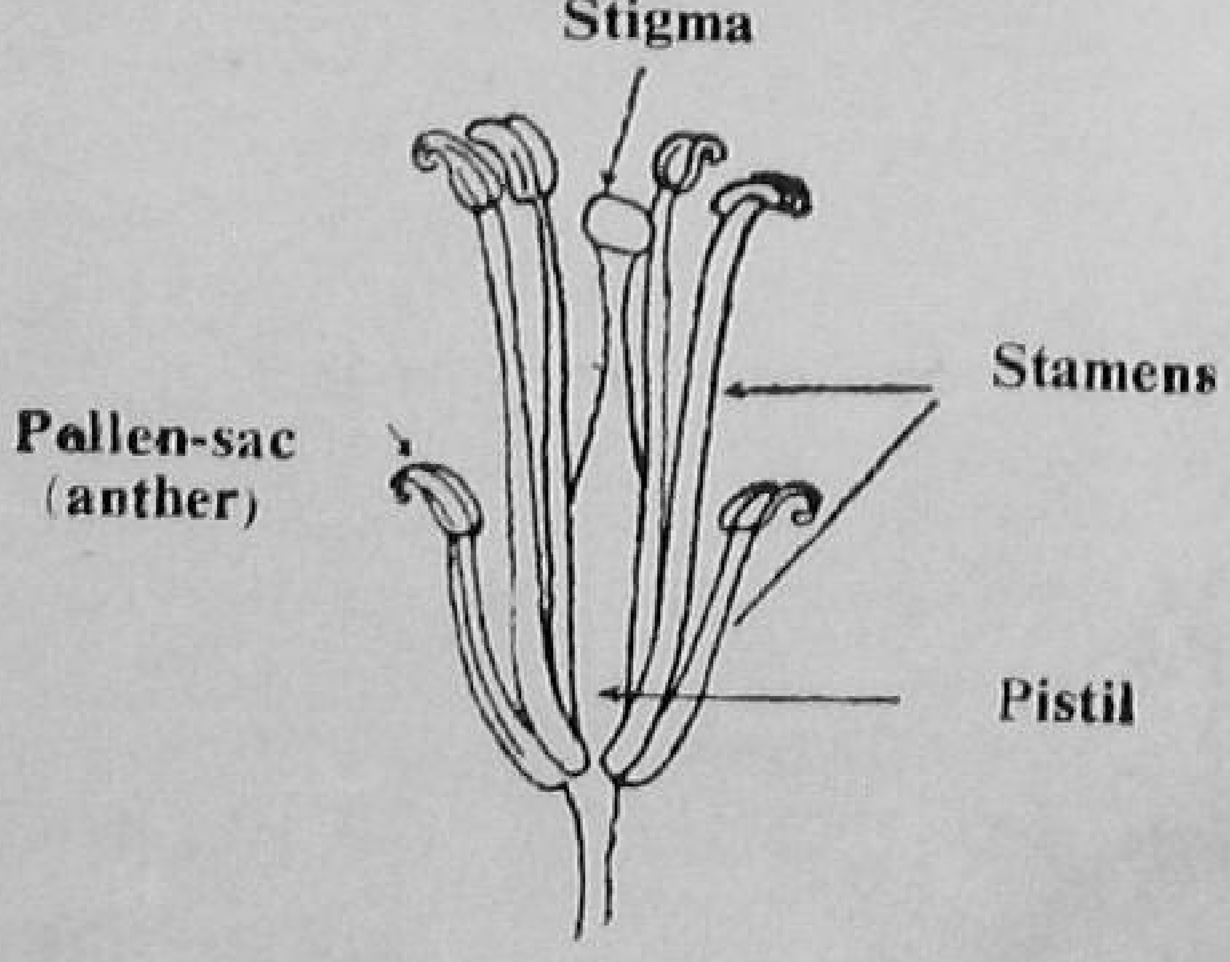
But what is not so well-known about the honey-bee is that it also helps pollinate a large number of our crops, and thus helps increase crop-yields. Several varieties of fruits, clovers, oilseeds and cucurbitaceous vegetables like the gourds, benefit from this activity of the bee. Scientists today hold the view that the service that the bee renders to the human race lies not so much in the production of honey as in pollinating and thereby increasing the production of field, vegetable and fruit crops.

In all flowering plants, propagation is mainly by seed. For successful seed production, it is essential for the pollen from the anthers of the flowers to fall on the stigmas. This is called pollination. After pollination, the pollen grains travel into the ovary from the mouth of the stigma and reaching the ovules, fertilize them. Thus fruit and seed are formed.

A mustard flower



The flower without the petals and sepals



In nature, several agencies do the work of pollination, e.g , air, rain, birds and insects. Of these, insects are the most dependable agents. Pollination by other agencies is very uncertain.

Of the insects, the honey-bee is the most efficient and dependable agent for pollination purposes. The food of the bee being the pollen and nectar, it visits a large number of flowers. It is faithful to one flower species during a visit and thus ensures fertilization. The size of the bee is such that it can visit most flowers. Man can take advantage of this habit of the bee by taking it to the area where pollination is needed.

The old method of honey production consists in periodically destroying the bees and their nests and squeezing out the honey out of the combs. The combs not only contain honey, but also pollen and larvae, which get mixed with the honey along with the dirt and sweat of the hands when the combs are crushed. Such an extraction, apart from giving honey which is unhygienic, also results in the destruction of the combs and of the young bees in a cruel manner.

By following modern methods of bee-keeping, however, the loss of bees and combs can be altogether avoided.

Honey can be extracted with the help of a simple machine and untouched by hand. This makes the use of the same colonies for producing honey possible season after season, and for an indefinite period.

Honey-bees cannot be tamed as we tame and keep a dog, a cat or a cow. A study of their habits and behaviour, therefore, will help in getting the maximum advantage out of them.

Bee-keeping on a small scale does not require much of capital. Initially, the only expenditure involved is on the purchase of hives and other tools. Thereafter, only a small expenditure is needed for maintaining the hives. You can

make a start with as little investment as a hundred rupees. Unless there is any serious upset, you can recover this amount as profit in two years.

Anyone, old or young, can keep bees with profit. The labour involved in bee-keeping being light, it can be a highly suitable occupation for women and children.

Bee-keeping can be made one's sole source of income, but in the beginning it is best taken up on a small scale as a cottage industry to attend to in one's spare time, either to provide honey for one's own use or to get a supplementary income out of it by its sale. You can keep from two to twenty hives without any strain on your capital, resources, space, labour or time. You can extend your operations after you have gained sufficient experience.

In bee-keeping, bees are the labourers. The bee-keeper's labour consists of a few intelligent manipulations three or four times a month. Even a score of hives will not take more than half a day's time of the bee-keeper.

Bee-keeping can be practised in any area where there is sufficient bee pasture of some wild shrubs, fruit orchards and cultivated crops. Bees can not only be kept in rural areas, but also in big cities.

Bees do not require any special accommodation. Beehives can be kept in one's courtyard, in the verandah of the house or even on the roof.

The raw material required for honey production is the sweet juice, called nectar, produced by flowers. While all flowers do not produce nectar, among those which do, some secrete more and some less. Those that produce a large quantity of nectar are naturally the ones most useful for honey production. To mention a few which produce good nectar: apples, pears, apricots, plums, guavas, citrus, *jamun* (*Eugenia* sp.), loquat, persimmon among

fruits; *sarson* (*Brassica* sp.), legumes, buckwheat and cotton among field crops ; *tun* (*Cedrela toona*), *shisham* (*Dalbergia sissoo*), *semal* (*Salmalia malabaricuam*), soapnut, wild cherry, tamarind, eucalyptus, *sal* (*Shorea robusta*), bottle brush, horse chestnut and Indian elm among forest trees; beans, cucurbitaceous plants, lady's finger and radish among vegetables. Some weeds and wild shrubs also provide nectar to the bees.

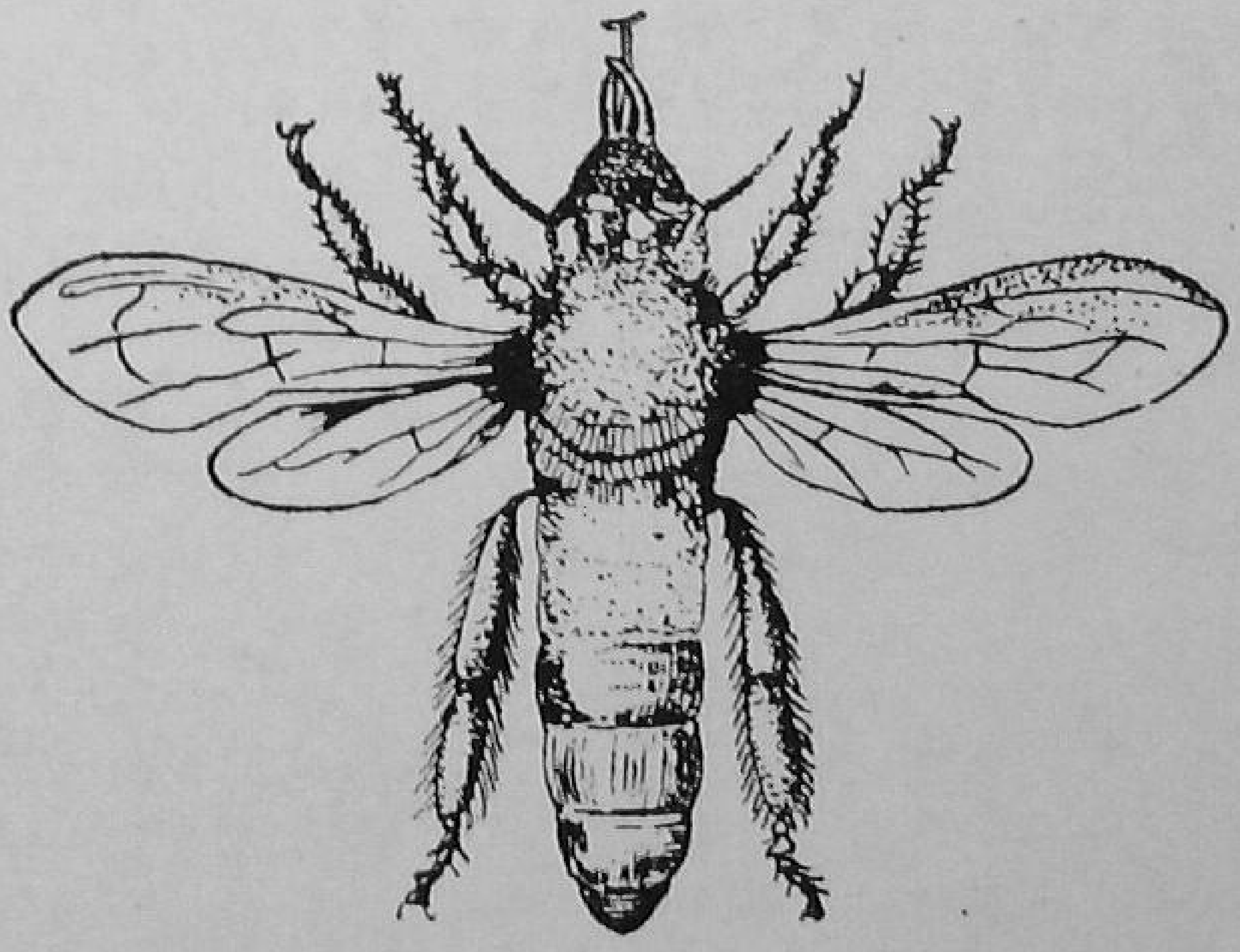
Besides nectar, flowers also have pollen. Some flowers secrete nectar and also provide pollen. There are others which provide only pollen. The number of such trees is very great.

Bee-keeping, besides being remunerative, can be a very pleasant and fascinating pastime. It has an excellent educative value both for the young and the old.

Kinds of bees

Three kinds of honey-bees are found in India. They are the rock bee, the little bee, popularly known as *choti makhi*, and the Indian hive-bee.

The rock bee (*Apis dorsata* F.), builds a single large comb in the open, on tree branches or eaves of high buildings or overhanging rocks.

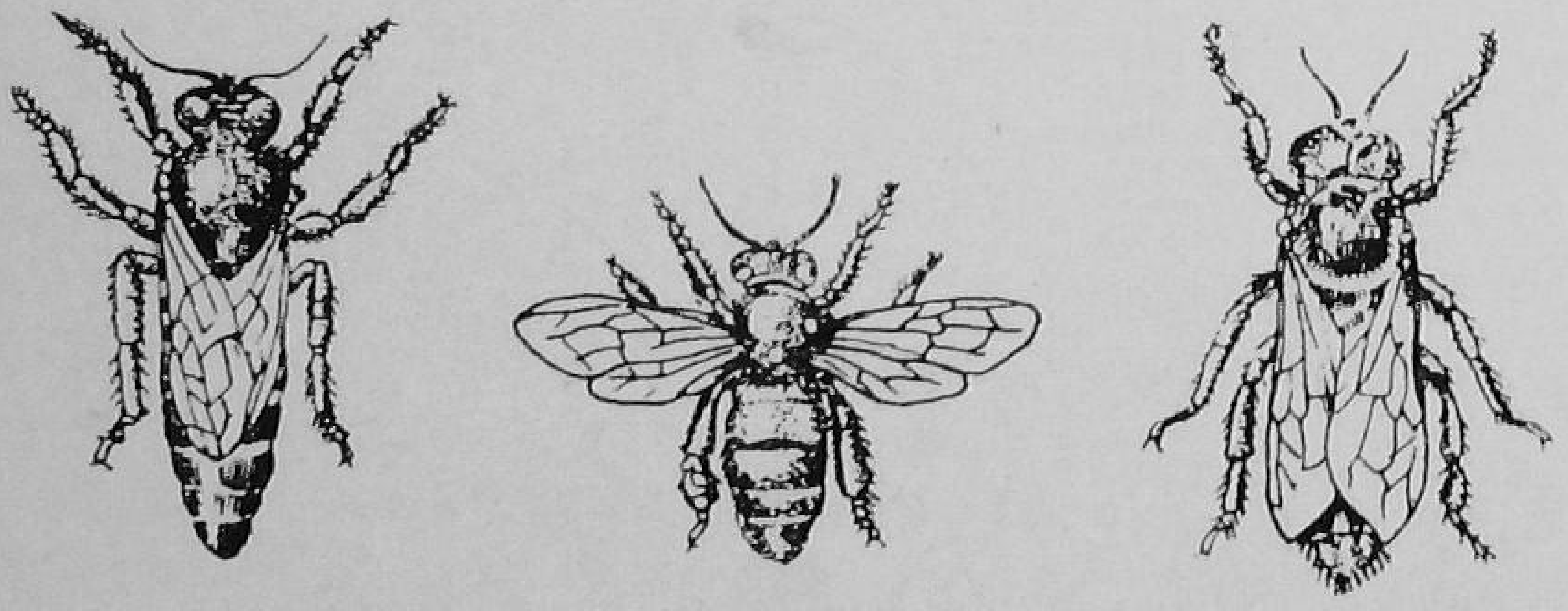


An *Apis dorsata* worker

This bee produces large quantities of honey, but has a ferocious temper. It has not yet been successfully hived. Though some experts are able to handle it without any difficulty, it is dangerous for beginners to meddle with it, and they are well advised to refrain from handling it.

The *choti makhi* (*Apis Florea* F.) like the rock bee, also builds a single comb in the open on branches or in bushes. It cannot withstand a cold climate and, therefore, lives mostly in the plains. The bee is very small in size. The comb it builds is small, generally of the size of the palm of one's hand. In more suitable localities, however, some varieties of this bee build larger combs, which may be even a foot or more in length. The yield of honey is very little. On the whole it is not economical to keep this bee.

Apis florea

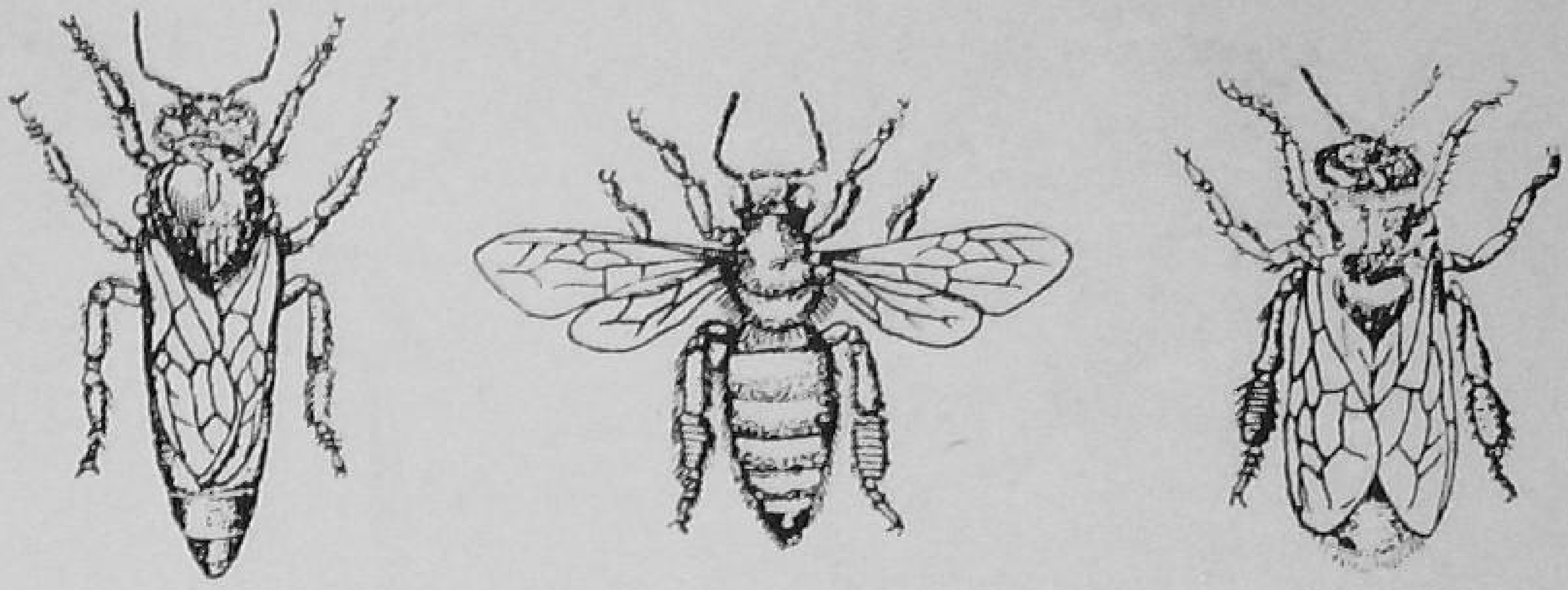


Queen **Worker** **Drone**

The Indian hive-bee, popularly called *mauna* (*Apis indica*), is widely distributed throughout India. It builds several parallel combs inside cavities and hollow trees. It lives and works in the dark. In size, this bee is bigger than *A. florea* and smaller than *A. dorsata*.

This is the bee which can easily be domesticated and kept in modern hives. It has a good temperament and can be manipulated with ease. Some bee-keepers keep these bees in recesses or holes in

Apis indica



Queen **Worker** **Drone**

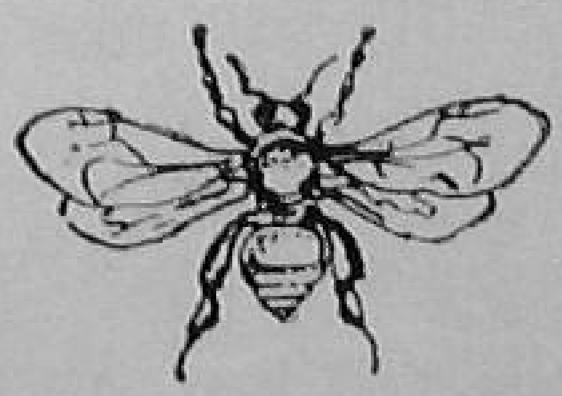
the walls of their houses, in empty wooden cases or in hollow logs.

There are two varieties of this bee, the plains variety and the hill variety. The hill variety is somewhat bigger in size and is of a dark colour. The plains variety is yellowish in colour. At the base of the hills both varieties are commonly met with.

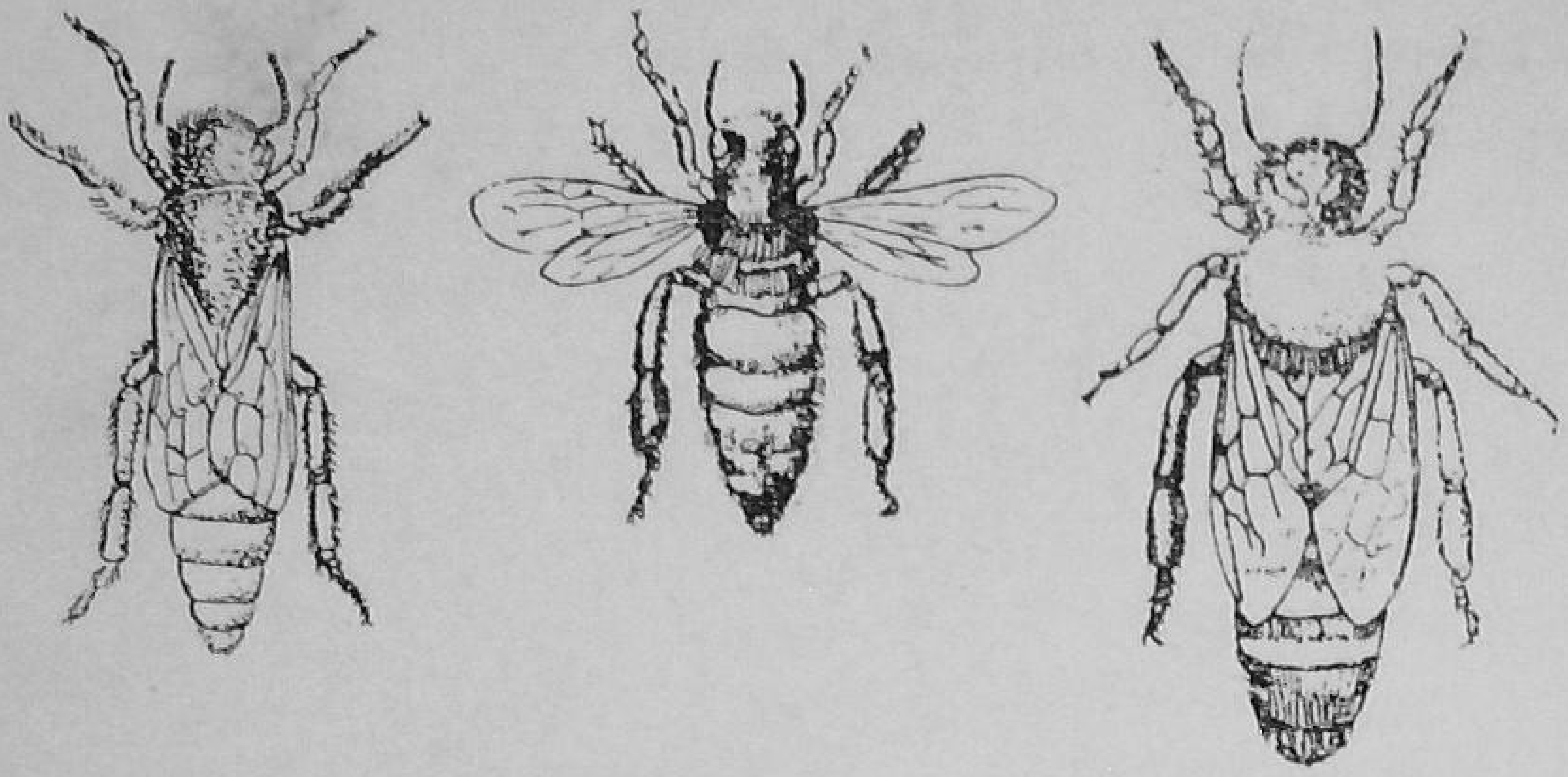
The plains variety builds worker brood cells measuring $\frac{1}{6}$ inch in diameter (six cells to a linear inch). The hill variety builds larger cells which increase slightly in size from $5\frac{1}{2}$ cells per inch to $5\frac{1}{4}$ cells per inch, with increase in elevation.

Besides the above three kinds of honey-bees proper, there are various kinds of stingless bees (Dammar bees) which also produce a little honey. The variety most commonly found in India is a bee of a very small size, and belonging to the genus *Melipona*. It inhabits such places as tree trunks and crevices of walls. The amount of honey produced is very small, and, therefore, this bee is not fit for keeping for honey production. Some species

A Dammar bee



Apis mellifica (**Italian**)



Queen **Worker** **Drone**

of this bee found in other countries like Brazil are much bigger in size and produce fair amounts of honey.

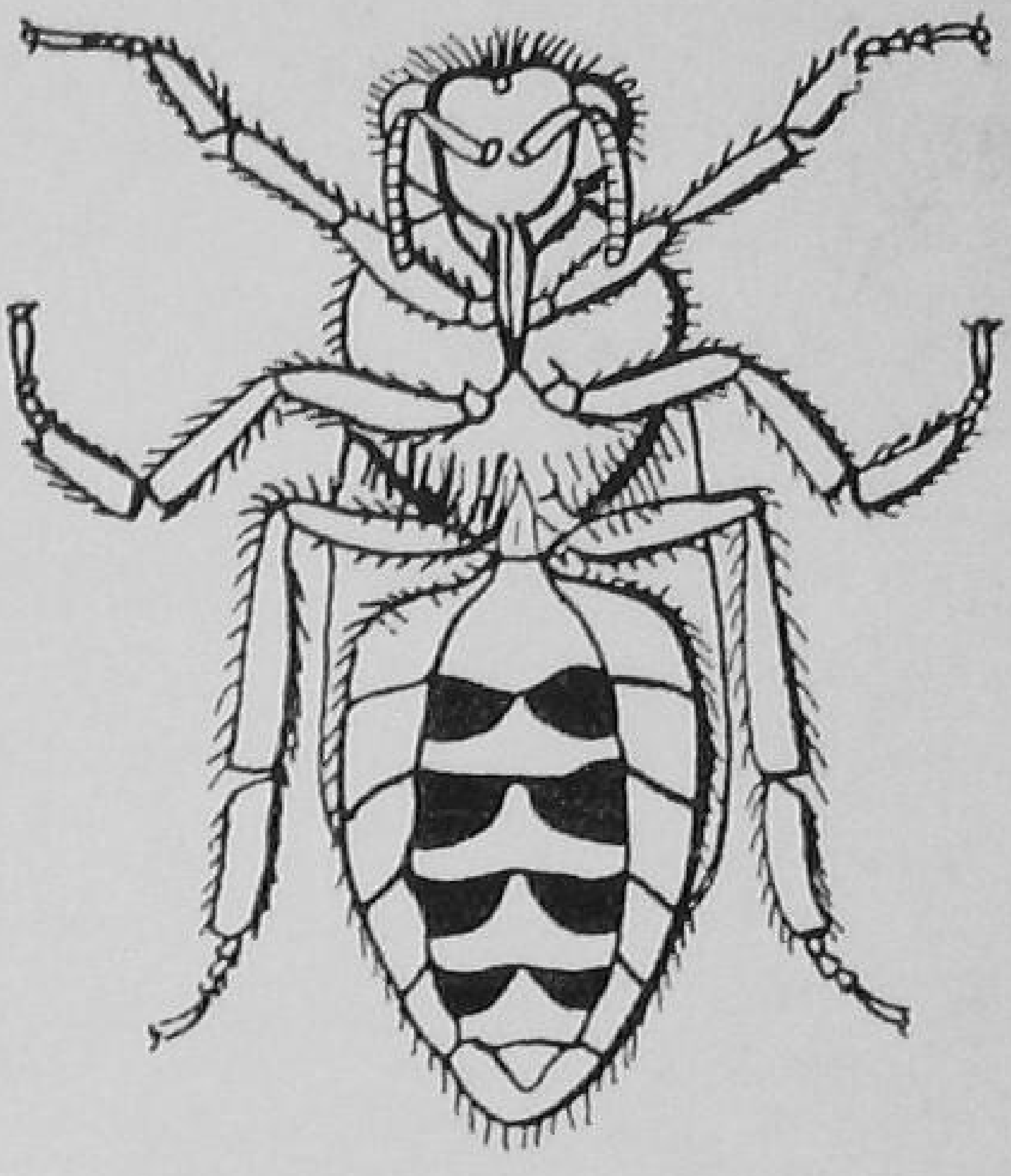
In this Bulletin, the Indian hive-bee alone is dealt with.

How honey is made

The honey-bee sucks the nectar with its tongue from the nectaries of flowers and takes it into the honey stomach, where some enzymes secreted by the salivary glands get mixed with the nectar and convert the sugars contained in it into the simple sugars contained in honey. The liquid is then regurgitated by the bee and stored in the storage cells in the comb. At this stage, it is called unripe honey. In the cells, the liquid is thickened by evaporation, and when it acquires the right thickness, the honey is said to be ripe. The mouth of the cell is then closed by the bees with wax. This is called "capping" or "sealing" of the cells. Sealed honey cells contain ripe honey. Unsealed honey cells contain unripe honey.

How beeswax is made

Beeswax is made in the body of the bees. Bees eat a lot of honey and then hang motionless in chains for several hours and secrete wax from the wax-glands which are found under their



A worker bee turned on its back (magnified view) showing the wax plates (shaded portions)

abdomen. They have to consume a considerable quantity of honey to produce a little of the wax.

Individuals in a colony

Honey-bees are social insects and live in colonies. The number of individuals in a colony varies from 3,000 to 40,000 depending upon season and locality. Three types of individuals are found in a colony—the queen, the males or drones and the workers.

The queen. There is one queen to a colony. She is the biggest individual in the colony in size, and the only fully developed female. Her only function is to lay eggs. She is not a queen in the sense that she governs or commands. She is just the mother of all the individuals in the colony. Her normal life is about two to three years, but when she grows old and her power of laying eggs declines, she is killed by the workers and another young queen is bred to replace her.

The fertilized queen lays fertilized eggs or unfertilized eggs

at will. Fertilized eggs produce female bees ; unfertilized eggs produce males or drones. If a virgin queen were to lay eggs, only males will be born, because a virgin can only lay unfertilized eggs. When young, a good fertilized queen can lay up to 1,000 eggs in 24 hours.

The queen has a sting, but she uses it only against another queen. She does not leave the colony except for mating and when swarming. She is fed and looked after by the worker bees, who also remove her excreta.

The drones. In each colony, there may be 200 to 500 male bees or drones. Drones are bigger in size than the workers. They have a black, rounded abdomen. They have no sting. Their only function is to fertilize the queen. During winter, and when there is dearth of food, they are driven out of the hive by the workers and allowed to perish. They are always produced in the breeding season (spring or autumn) for purposes of mating.

Worker bees. The rest of the individuals in the colony are worker bees. These are undeveloped females and do all the work in a colony except laying eggs. They have striped abdomens which are pointed. At the point of the abdomen is the sting. This sting is barbed, so that when a worker bee stings, it cannot withdraw the sting owing to the barbs. The sting gets pulled out of the body. The result is that the bee itself dies after some time.

Sometimes, in the absence of the queen from a colony, some worker bees take upon themselves the function of laying eggs. These workers are called laying workers. Their eggs produce only drones. They do not lay eggs systematically as the queen does. Often, several eggs are laid in one cell and in this way, the presence of laying workers can be recognized. The queen never lays more than a single egg in a cell, and lays them in a regular pattern.

The workers for the first two to three weeks of their lives perform household duties like the cleaning of cells and feeding the young. The bees which feed the young are known as nurse bees.

When two to three weeks old, the bees learn to fly. During midday, they fly out of the hive and keep flying for some time, with their faces towards the hive. They not only learn to fly this way, but also to recognize the hive. This is known as the midday flight or play flight.

When the bees have learnt to fly, they become foragers, i.e., they fly out and search and gather nectar, pollen and water for the rest of their lives. They bring nectar and water in their honey stomachs. The pollen is brought packed in what are called pollen baskets on their hind legs. They also gather bee glue or "propolis".

The workers have no fixed life. They are capable of living up to four or five months during winter and the inactive period. When the work is hard, they live for five to six weeks only.

The comb

The comb is made from beeswax. It consists of hexagonal cells. There are the following different kinds of cells in the nest :

1. *Attachment cells* : for attaching the comb to the top and sides of frames
2. *Storage cells* : for storing honey and pollen
3. *Brood cells* : for rearing the young. The brood cells are again of three kinds : worker cells in which worker bees are reared, drone cells in which drones are reared (these are larger in size than the worker brood cells) and the queen cells which are built only when queens are to be reared. These are of the shape

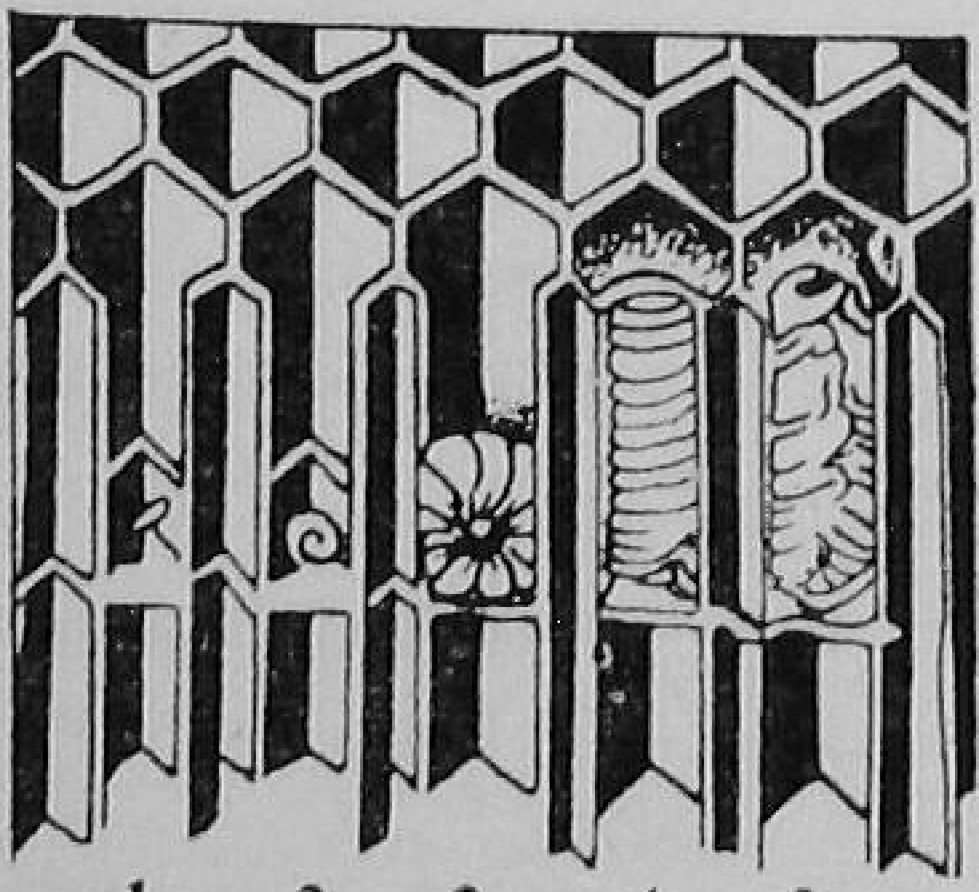
of a groundnut and placed generally on the lower edges of the comb.

Honey is placed in the topmost portion of the comb. Next to it are cells stored with pollen. Below these are the eggs and the brood.

Life cycle

The bee passes through three stages—the egg, larva and pupa, before it becomes an adult. The duration of each stage is given below :

Type of bee	*Egg stage*	*Larval stage*	*Pupal stage*	*Total*
Queen	3 days	5 to 5½ days	7 to 7½ days	15 to 16 day
Worker	3 ,,	5 to 6 ,,	10½ to 11 ,,	18½ to 20 ,,
Drone	3 ,,	6 to 6½ ,,	14 to 14½ ,,	23 to 24 ,,



1 2 3 4 5

VARIOUS STAGES OF LIFE OF THE BEE

1. Egg 2. Newly hatched larva 3. Developed larva 4. Pupa 5. Nymph

During the first two and a half to three days, all larvae are fed with a special food secreted by young bees and known as "royal jelly" or "bee-milk". The queen is fed with this special food for the full period of her larval life. The others are fed

with coarser food made from pollen and honey and known as "bee-bread" after the first two and a half to three days.

At the end of the larval period, the cell is capped flat with a mixture of pollen and wax. The capping of honey and of the brood can be easily distinguished. Honey is capped with pure beeswax which is generally white in appearance. The drone brood cells are generally capped with bulged cappings which have often holes in the centre.

Habits

Honey-bees are probably the most perfectly organized social creatures. Their organization is older than that of man.

The honeycomb which they build from beeswax is a piece of great engineering skill. It is kept very clean. The bees always cleanse themselves outside the hive. Bees also die generally outside the hive and thus save the rest of the colony the labour of taking the bodies out. Any bee which may happen to die inside the hive is thrown out by other workers.

The division of work and duties inside and outside the hive is automatic. There is no taskmaster to issue orders or to assign duties. What duty a particular bee will perform at a particular time depends partly on her age and partly on the requirements of the colony.

The industry of the bees, their selfless devotion to duty, frugality and the efficiency of their organization have been objects of wonder and admiration to naturalists and philosophers from time immemorial.

The organization of the bee colony centres round the queen mother, as she is the sole source of new individual members of the colony. Should a queen be lost or killed accidentally, the bees show great distress and search for her everywhere. Then, within a few hours, hurried preparations start for the rearing of

another queen. This is done by building several queen cells, from two to three to a dozen or more, and feeding the young larvae therein copiously and with great care and tenderness. When the larvae are fully developed, the queen cells are capped.

When the pupae inside are fit to emerge from the cells, the bees thin the cappings of the cells. The cappings of "ripe" queen cells look brown and are very thin. Then the queen inside cuts this cap in a circular pattern and presses herself out of the cell pushing open the lid. Out of the cell, she dries herself and then takes some honey from the honey cells. After three or four days, she flies out daily to mate. Mating always takes place in the air. If drones are in abundance, she may get mated the very first day. Otherwise, she may have to go on more than one flight. When drones are absent, she may fail to get mated altogether.

A virgin unable to mate for about 15 days loses the ability to mate and must remain a virgin for ever. She can then lay only unfertilized eggs from which drones may be reared. She soon dies a natural death, or is killed by the workers. The drone dies at the time of mating. When a queen is successfully mated, she destroys any virgins or queen cells in the colony. Normally, a queen mates only once in her lifetime.

Drones consume a lot of food, but have no duty except that of mating with the queen. They do not even collect their own food.

Generally, there is only one queen in a colony. If there be more than one, they fight till one is killed. The other bees do not interfere in the fight. Sometimes, an old queen and her young daughter may continue to live together peacefully for some time, laying eggs in different parts of the comb.

In spring, and also in autumn in some places, when

the colony condition is prosperous and a lot of food is coming in (weather conditions outside being good), the old queen and some bees issue out as a swarm after filling their stomachs with honey. They go and establish a new home. This is the natural way of increasing the number of colonies. Before the bees swarm, they build queen cells so that the portion of the colony left behind will also have a queen in due course. Sometimes, when a colony is very strong and conditions are favourable, more than one swarm may issue from the same colony.

In places where the winter is severe, especially on the hills, the bees do not come out during intense cold but cluster inside their nest and keep warm with the heat of one another's bodies. They consume honey and by muscular exercise produce heat for warming themselves. During this period, they consume the honey which they have stored. In fact, the bees store surplus honey for their use during the winter period when they cannot go out to fetch any food, and when even if they did go out they would not find any flowers. Also, this surplus is stored by them as a provision against periods of dearth of bee pasturage.

On the hills, where the rainy season is intense and prolonged, the bees cannot fly out and need stores of food inside the hive.

Each colony has a number of guards at the entrance. They do not allow strange workers or queens to enter, but drones are allowed free entry in all hives. Also, if a worker bee laden with nectar or pollen mistakes another hive for its own and comes in by mistake, she is not interfered with.

Bees recognize the whereabouts and colour of their hive. Thus if a hive is shifted even a few yards from its position, the majority of the bees will fail to find it. They will keep on hovering at its original place. This instinct of the bee has to be carefully noted by the bee-keeper. When a hive is to be moved a short distance, it should be done in short shifts of one to two

yards per day. When a hive is to be shifted a long distance, the hive entrance should be closed with a piece of wire gauze and the hive moved, preferably during the night. When the entrance is opened at the new place, the bees orientate themselves again and mark their new abode.

Each colony possesses a distinctive "hive odour" which is also possessed by the individuals of the colony and enables guards to spot out strangers.

TOOLS OF THE BEE-KEEPER

THE essential tools required in modern scientific bee-keeping are few and simple.

The beehive

This is the most important tool. The chief feature of the modern scientific hive is that the combs are built inside frames which hang vertically from the top bars and can be removed independently of one another. This is known as the movable-frame hive. The principle of the movable-frame hive, namely, the bee space, was discovered by the Rev. L.L. Langstroth, an American, in 1851.

Before Langstroth, beehives could not be examined or manipulated because the combs were fixed, being attached to the top of tne box or other structures containing the brood nest. Langstroth's discovery revolutionized the art of bee-keeping and made it scientific. It made the examining of bees possible by taking out the frames one by one.

In a beehive, the most important feature worth careful noting is the "bee space". This is the space which the bees neither propolise nor build comb in. It serves as a passage between combs or between the walls and floor of the hive and the combs. In the case of the hill variety, this space may be taken as 5/16

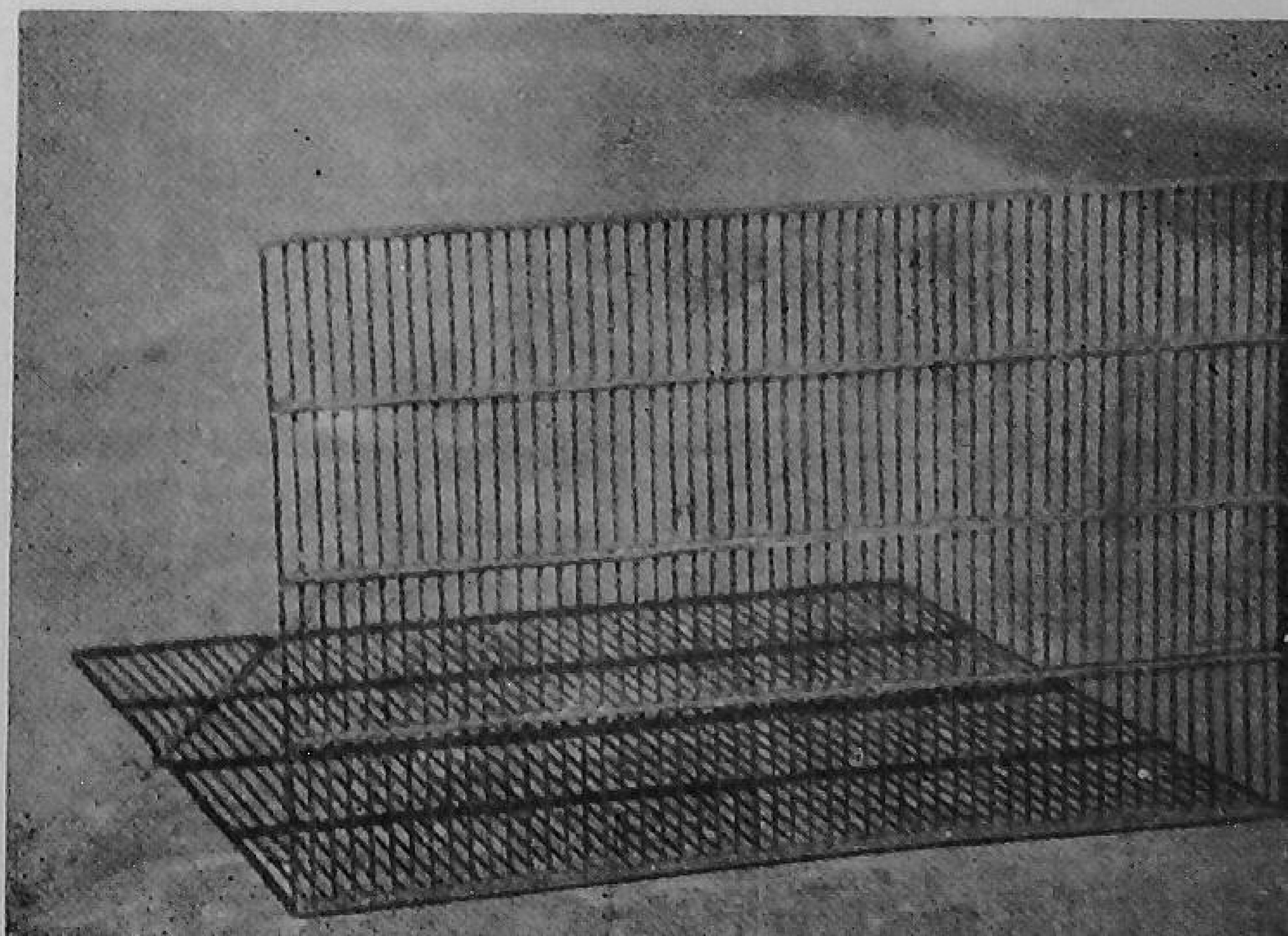
inch. In the case of the plains variety it is slightly less. Any disregard to this single feature will render the hive useless for purposes of manipulation. If the bee space is kept less than the correct size, the bees join up the two combs and they cannot be removed independently for examination. If the bee space is kept more than the correct size, the bees build combs in-between the two combs. This again hinders manipulation and examination of the hive.

One fool-proof contrivance for keeping the frames at the correct distance from one another is known as the self-spacing frame. In this, top portions of the side bars are made wider than the rest of the bars. The top portions are of such width that when two frames are placed side by side with the ends touching, the correct bee space is ensured.

A hive has a bottom board on which is placed a wooden box called the brood chamber fitted with movable frames. It is in this brood chamber that the queen and the workers live and breed. On the top of this is another similar chamber into which the queen is not allowed access. The result is that in this upper chamber, known as the "super", no eggs are laid and only honey is stored. The supers are placed on the brood chamber only during the honey flow season when bees store the surplus honey.

For preventing the queen from going up into the super, a simple contrivance, known as the queen-excluder, is used. This

Queen-excluder



consists of a frame fitted with wires, or a zinc sheet with holes in it. The distance between the wires, and in the case of the perforated zinc sheet the size of the perforations, is such as to allow the workers to pass through them, but not the queen, she being bigger in size than the workers.

On the top of the super is an inner cover, and then the roof.

The honey-bees can withstand great extremes of climate, but not without suffering. Thus the first essential of a good hive is that it should afford the bees protection against the extremes of climate—the great heat of the summer sun, the rigours of snow and frost in winter, hot summer winds (*loo*) and cold winter winds, rain, hail and storms.

To afford effective protection, the hive must be made of strong thick wood, well-assembled and properly joined together. The bee space should be correct, the frames well made, angles correct and strongly joined. The walls of the hive should have a minimum thickness of 7/8 inch for affording protection to the bees and giving strength to the hive. The roof should be leak-proof, which can best be done by covering it with a galvanized iron sheet. The wood used should not crack or give out a bad smell. It should be well seasoned, so that it does not warp. The joints of the hive body should be dovetailed and well nailed.

Provision should be made for ventilation. The roof should be high enough to have ample space between the top of the frames and the bottom of the roof. This affords protection from the hot sun and also helps in ventilation.

The hive should be painted outside with two coats of paint. This is primarily for protecting the wood from the weather, but it also helps the bees to easily spot and recognize their hive. White paint is good. Yellow and green are the other colours easily distinguished by the bees.

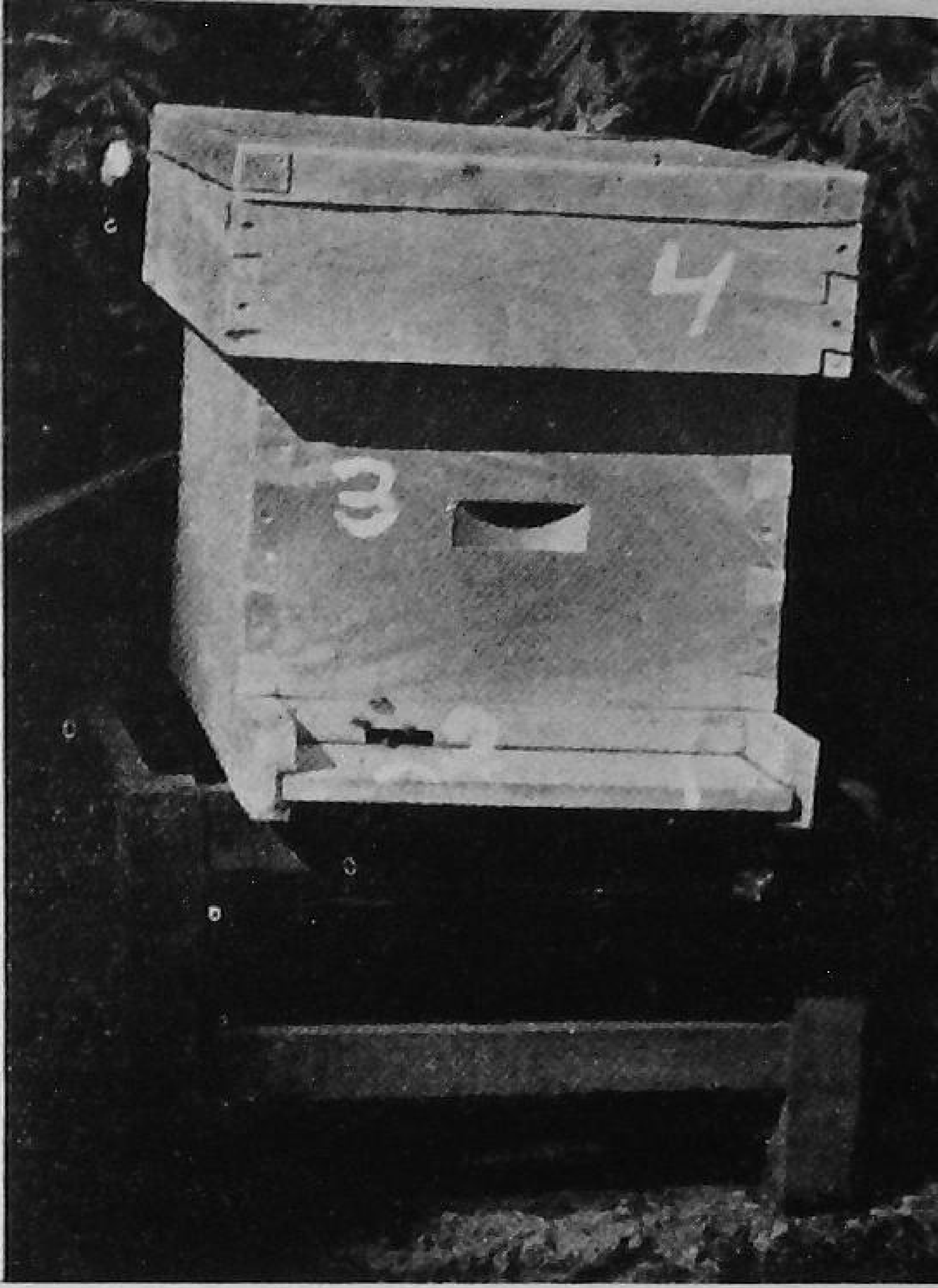
Also the hive should be of a simple construction and easy of manipulation by the bee-keeper. Hives opening from the top are suitable from the point of view of manipulation.

The size of the hive is another important consideration. The Langstroth dimensions are in use in most parts of the world where modern bee-keeping methods are being followed, and are recommended to all bee-keepers.

In India, bee-keepers generally prefer a smaller hive, as it is cheaper in price and easier to manipulate. At the Uttar Pradesh Government Bee-keeping Station, Jeolikote, a standard type of hive, known as the Jeolikote Villager Standard Hive has been evolved. This hive has proved useful both on the hills and in the plains and has found general acceptance and popularity. The hive has eight frames, and lately, a 10-frame hive of this type is being increasingly used on the hills.

Bee veil

This veil is worn by the bee-keeper to protect



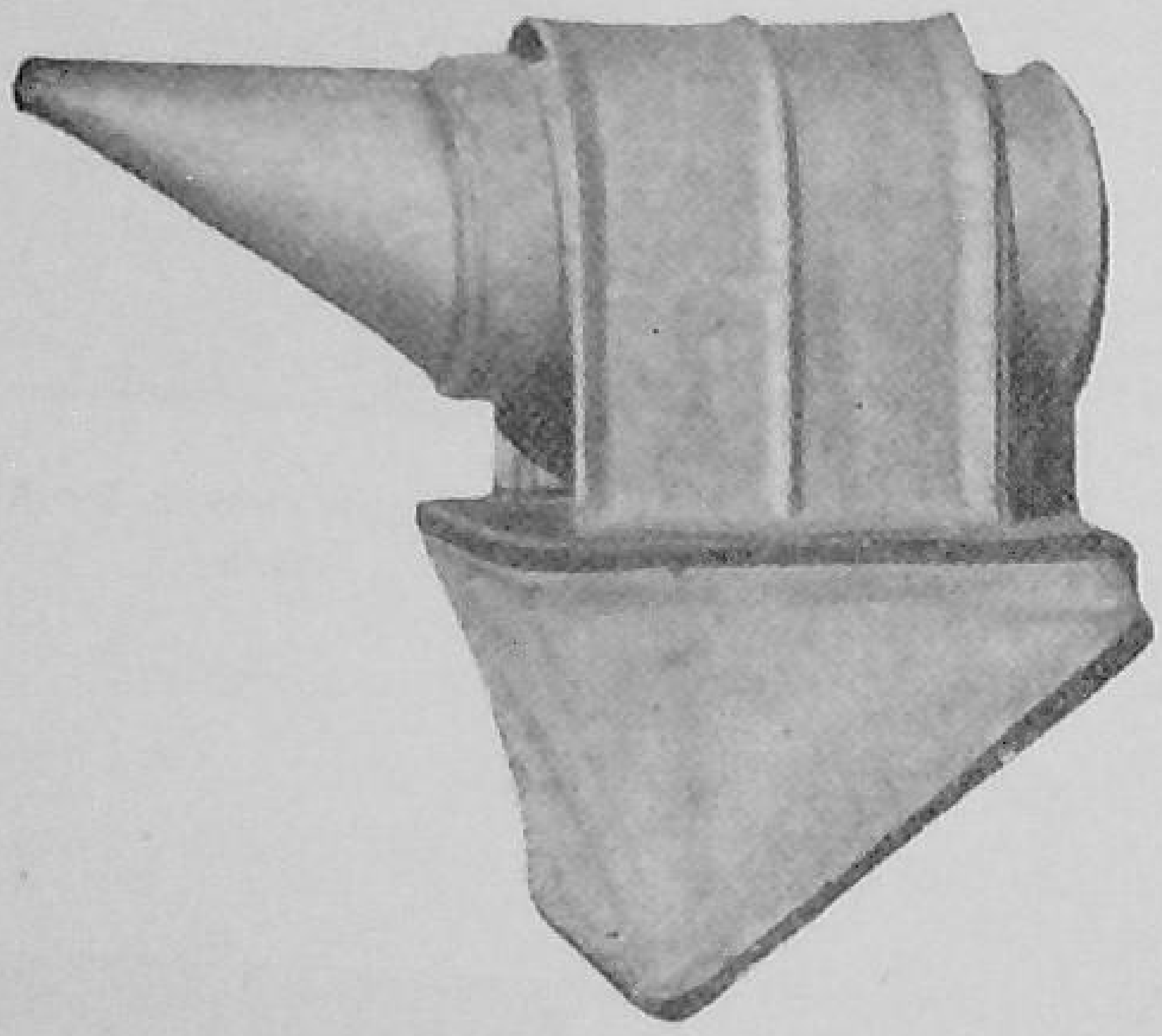
The Jeolikote beehive showing 1. Floor board 2. Entrance 3. Brood chamber 4. Roof

Bee veil

himself from bee stings. It does not interfere with his manipulation, but helps him get the confidence required in his work.

Smoker

Sometimes bees get into a bad mood and try to sting the bee-keeper when he attempts to open the hive for inspection. The smoker comes in handy at such times. A little smoke administe-



Smoker

red with it quickly subdues the bees. Hot smoke or sparks, however, should not be allowed to enter the hive. Also, no more smoke than is necessary should be used.

Hive tool

This is a long narrow piece of flat, strong iron and is used for cleaning and scraping the bottom board, for prying hive bodies apart and separating and cleaning frames.

Hive tool

Bee gloves

Bee gloves

These gloves are used by beginners to protect their hand from stings. They need not, however, be used, save in exceptional cases.

Queen-excluder

This has already been described on pages 17-18.

Queen-introducing cage

This is a cage made of wire gauze, and open at two ends. It is used for introducing a new queen into a queenless colony. The queen is introduced into the wire gauze cage from one end and this end is closed with a piece of iron or wood. The other end is closed with "queen candy" made by kneading fine powdered sugar with a little honey till it acquires the consistency of dough.

The cage is then placed inside the hive, preferably on the top of the frames. The bees cannot at once get at the queen, but

begin to eat the candy. The queen eats the candy from inside. In about 24 to 48 hours, the bees would have made a hole in the candy big enough for the queen to pass through. By this time, the bees and the queen would have become well acquainted with one another, and the queen would have had time to acquire the hive odour.

Generally, the bees welcome her and escort her to the broad frames where she commences her work. If the bees fail to eat the candy in 48 hours, the queen should be taken out and directly released or the candy scraped out and the cage with the queen inside replaced in the hive.

Queen cell protector

Sometimes, the bee-keeper wants more than one queen from a colony which has built up queen cells. In such a case, to prevent the first queen and the bees from destroying the other queen cells, a guard called queen cell protector is used. It is also used to guard a queen cell given to a queenless colony, till the bees have accepted it.

Uncapping knife

This is just a knife with a long broad blade used for opening the cappings of sealed honeycombs before placing them in the honey extractor. Before use, it is heated by placing it in hot water. When a large number of frames are to be dealt with, a pair of knives should be had, so that while one is getting heated, the other one can be used.

Honey extractor

This consists of a drum made of strong tinned iron, with a hole at one side in the lower portion. Inside the drum are "pockets" fenced with wire into which frames filled with honeycombs are placed after uncapping them. The pockets are made to rotate round a central rod, and centrifugal force is generated, which

throws out the honey from the combs on to the sides of the extractor drum. From the sides, the honey flows down to the bottom and is carried out through the hole or "honey gate." Throughout these manipulations, the honey need not, and should not, at any stage, come in contact with the hands of the operator.

When the honey has been thus extracted, the empty frames with the combs undamaged are taken out of the extractor and given back to the bees if the honey flow is still on; otherwise, these combs are carefully preserved for use against the next flow.

Comb foundation

This consists of sheets of beeswax on both sides of which are embossed the exact shape and pattern of the comb cell bases. These comb-foundation sheets are cut to the size of the frames and are fitted inside them. The frames are first wired with thin but strong tinned iron wires. These wires may be used horizontally or vertically or diagonally so long as they reinforce the comb foundation, so that the comb built on it does not break during honey extraction. Most often the wires are strung horizontally, three equidistant and parallel wires being used with each frame, from side to side, through the side bars. It is of the utmost importance that the wires are exactly in the centre of the frame, so that the comb-foundation sheet fixed on them is absolutely in the centre. Otherwise, the combs built will not be properly centered and will remain defective.

The wire embedder

This is a metal disc of the size of a four-anna bit, or a little larger, with a groove all round the middle of its edge, revolving on an axle, with a handle attached to it. A "wheel" or disc with spurs is more efficient. It is used for embedding the wires into the comb-foundation sheets. The wired frame is placed over the comb foundation and then the grooved disc of the wire embedder

is passed over the wire, exerting gentle pressure all the time, so that the wire becomes embedded in the wax of the sheet up to the centre of thickness of the sheet.

The dummy board

This is a board of the size of a frame. In a weak colony, the number of frames do not fill the entire brood chamber. The frames are pushed up to one side of the brood chamber and the dummy board is placed next to the last frame. In this way, a chamber closed all round, but smaller than the brood chamber, is produced. This is important in the cold weather for conserving heat in a weak colony or nucleus.

Wire entrance guard

It is a contrivance like the queen-excluder and is so constructed that when placed in front of the entrance of a hive, it prevents the escape of the queen. It is used by some bee-keepers to prevent the hive from swarming or deserting. But at times this contrivance produces undesirable results. In any case, it is an unnecessary hindrance in the normal work and activity of a colony, and as such is not recommended. A better way of preventing the escape of a queen is to cut both her wings on one side up to 2/3rd the length of the wings.

Feeder

Feeders are used for feeding sugar syrup to the bees when there is a dearth of natural food. Feeders are of rapid or slow type. Rapid feeders are those which allow the bees to consume large quantities of syrup quickly. Any shallow basin may be used as a rapid feeder. Put the syrup into the basin and then place some green grass into it to prevent the bees from drowning in the syrup. Now place this basin over the frames of the brood chamber and cover up the hive. If one has empty drawn combs, they can be filled with syrup and placed inside the hive. For slow feeding, an empty cigarette tin can be used effectively. Make a few small

holes with a thin nail in its bottom and fill it with syrup. Place the tin on the top of the frames in the brood chamber. The bees will suck the syrup slowly through the holes in the bottom of the tin.

HOW TO START WITH BEE-KEEPING

THE first essential for a beginner is to learn as much about the behaviour of the bees as possible. A good knowledge concerning the nature and habits of the bees gives the bee-keeper a greater chance of success.

The next step is to procure the hives and the necessary appliances. The appliances should be chosen for simplicity of construction and durability, and only the most essential appliances without which the work cannot be carried on should be bought.

Beginners are advised to join the regional Bee-keepers' Association if there is one in the area. They should also visit some neighbouring bee-keeper and watch him manipulate the bees.

Next, the hive or hives should be installed at suitable locations. The beginner should commence with at least two to five hives. Further increase should be made on the basis of experience gained.

Select a place where the bees will not come in the way of passers-by, children, cattle, etc. The site where the hive is placed should receive the morning and afternoon sun, and some shade during the hottest part of the day. It is better, but not essential, that the hives face east. The place should be sheltered from winds.

The minimum distance between two hives should be six feet. The place where the hives are kept should be free from high

grasses or weeds. The bees require a length of flying space open in front of the hive entrance. Water should be reasonably near the apiary.

Before bringing in a swarm, the frames in the brood chamber should be fitted with comb foundations.

The next step is to procure bees. Some bee-keepers sell ready established colonies in hives, but this is expensive. The best, the most economical and the most interesting way to start with bees is to catch and hive a swarm.

Catching and hiving a swarm

During the swarming season, swarms issue from hives and wild bee-nests and cluster on places like the branches of trees. A swarm remains clustered in such a place for some time till the scouts of the swarm have found a suitable nesting place. The swarm can easily be secured at this stage. The bees can be shaken into a cloth bag and the mouth of the bag closed. Or, a basket may be placed above the cluster and the bees gently and gradually moved into the hollow of the basket. Smearing the inside of the basket with a little honey sometimes helps. When all the bees have entered the hollow of the basket, the basket can be carried home. Or, the tree branch may be cut without disturbing the bees and the cut branch with the bee cluster carried home. If the queen can be spotted, she may be caught and caged in the queen-introducing cage. The cage can be tied to the basket or bag, and the bees will cluster round it.

The bees should be kept in a cool dark place until late in the afternoon. In the meantime, place some sugar syrup in a feeder inside the hive and take the inner cover out. Replace the roof, place the inner cover in a slanting position in front of the hive entrance and shake the bees on it. They will soon march into the hive and occupy it. The process may be hastened by gently pushing a few bees into the hive entrance. Look out for the queen.

If the queen has been caught, place the cage inside the hive, when all the bees will quickly enter.

Sometimes a wild nest of bees is located inside a hollow tree, or underground, or in a cavity. Or, the bee-keeper purchases a bee colony in a box-hive or log-hive or wall-hive. In all cases, the problem of transferring the bee colony into the modern hive arises. It is a messy affair requiring a good deal of patience and tactful handling, but it is not difficult.

This work should be commenced about a couple of hours before sunset. The first thing to do is to widen the opening of the cavity (in the case of a wild nest) so that the hands of the operator can reach the combs, and the combs with the bees can be taken out of it. Smoke should next be administered to the bees in moderate quantities. Place the movable frame hive near the opening at a convenient place and within easy reach. The frames should be wired, but no comb foundation should be fixed in them.

Now take out all the frames from the brood chamber and place them near at hand. Commencing from one side, cut the combs in the cavity with a wet knife. Clean from the top where it is attached to the roof of the brood nest. Gently remove the bees from the cut comb by giving a few puffs of smoke or by using a soft brush. Take one of the wired frames, place the cut comb inside the frame flat on the wires, the top end where it has been cut touching the top bar. If the comb is too large for the frame, as sometimes happens, trim it to the size of the frame. Now press the comb very gently with the palm and fingers so that the wires get embedded into the comb up to the midrib or the centre of the comb. Tie it in position with a broad plantain fibre at two or three places and place the frame in the hive body at one end of it. Repeat this with the other combs, taking them one by one, till all the combs have been cut and tied in frames and placed in the hive.

A little smoke may be used each time a fresh comb is cut to clear it of bees, but too much smoke should not be used in the case of natural nests inside trees, etc.; otherwise, the bees and the queen recede too far into the cavity so that they would be beyond your reach. The bees left inside the cavity may be gathered gently in one's hand and shaken into the brood chamber of the hive. If the queen is seen, she may be caged in a queen-introducing cage and put into the hive. If the cage is not available, an empty match-box may be used, which should not be tightly closed but left slightly open for ventilation.

When the queen goes into the hive, or is placed inside it in a cage, all the other bees will quickly follow. Place the inner cover and roof on the hive and place the hive so that its entrance is very near the entrance of the old nest. The hive should be allowed to remain there till dark when all the bees will be back inside the hive. The hive entrance may now be closed and the hive carried gently to the place where it has to remain. This must not be less than two miles from the place from where the combs have been removed. If it be less than two miles, then the hive may be taken to a place at least two to three miles away and kept at that place for a week or 10 days and then shifted to its proper place.

The care of a newly transferred colony requires great attention. Transferring results in a temporary but complete disorganization of the colony and it takes the bees some time to recover from the effects of the shock. During this period, utmost care must be taken to prevent robbing. The hive entrance should be kept so small that only one or two bees can enter or leave the hive at a time. Some syrup may be fed through a rapid feeder, but the hive entrance must be closely watched for robbers. Do not disturb the colony for at least one week. In a few days, they will have joined the combs to the top bars of the frames.

Then the fibres binding the combs may be cut away and removed.

Manipulations with bees

Beginners are apt to be very keen to see what the bees inside the hive are doing. Consequently, they may open the hive too often and interfere with the bees. This has a bad effect on the bees, and so the tendency has to be checked if good results are desired. The less a working hive is opened and examined the better the output of bees will be.

It is necessary, however, to open the hive, say, twice or thrice a month, to find out :

1. The work of the queen. If the eggs of the queen can be seen, normally it is enough proof that she is present.
2. If the bees have sufficient food.
3. If the bees have sufficient space for expanding their nest.
4. If there is any attack by the wax-moth.
5. If the bees are making preparations for swarming. They give notice of this by making queen cells which can be easily distinguished by even a beginner.

During the swarming season, and when there is a wax-moth attack, a hive will have to be opened more often, say, once a week, or even at shorter intervals.

A colony should be examined at a time of the day when the bees are flying freely. In summer, it will be during the morning or the evening. In winter, it will be during the warmer part of the day. During the cold weather, the brood frames should not be exposed too long to the cold, as otherwise, the brood gets chilled. The hive should not be opened on a windy or rainy day or after dark. During the winter months, when the bees are not flying, the hive should not be opened or disturbed.

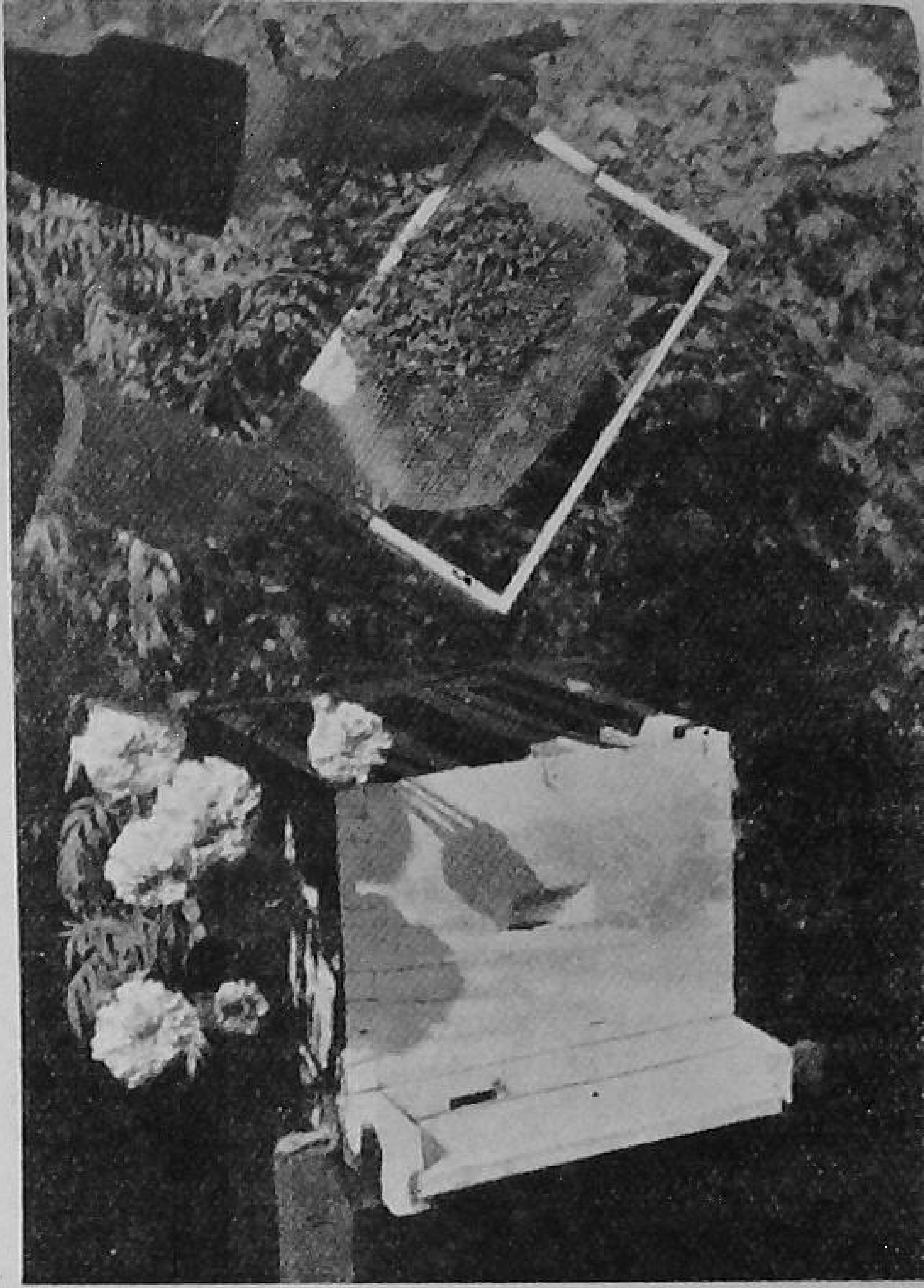
To examine the colony, stand on one side of the hive. Remove the roof and inner cover gently. Bees do not like jarring of any kind. Therefore, be slow and gentle with them, and avoid being stung and avoid all quick or jerky motions. The beginner should always use a bee veil. If on opening the bees appear to be cross, a few puffs of smoke will subdue them. The frames should be examined one by one by lifting them gently with the two hands, each hand catching one end of the top bar.

If the bees have used bee glue to fasten the frames, make use of the hive tool to pry them apart. The first frame examined should be made to stand vertically on one side of the hive. Now there is more room inside the brood chamber. Take up the frames one by one and replace them in the brood chamber in the order in which they were found. When all the frames have been examined, press them gently to one side and now replace the frame examined first. The frames should always be kept in a vertical or slightly slanting position while under examination. Cover up the hive as soon as you have finished the examination.

Finding the queen

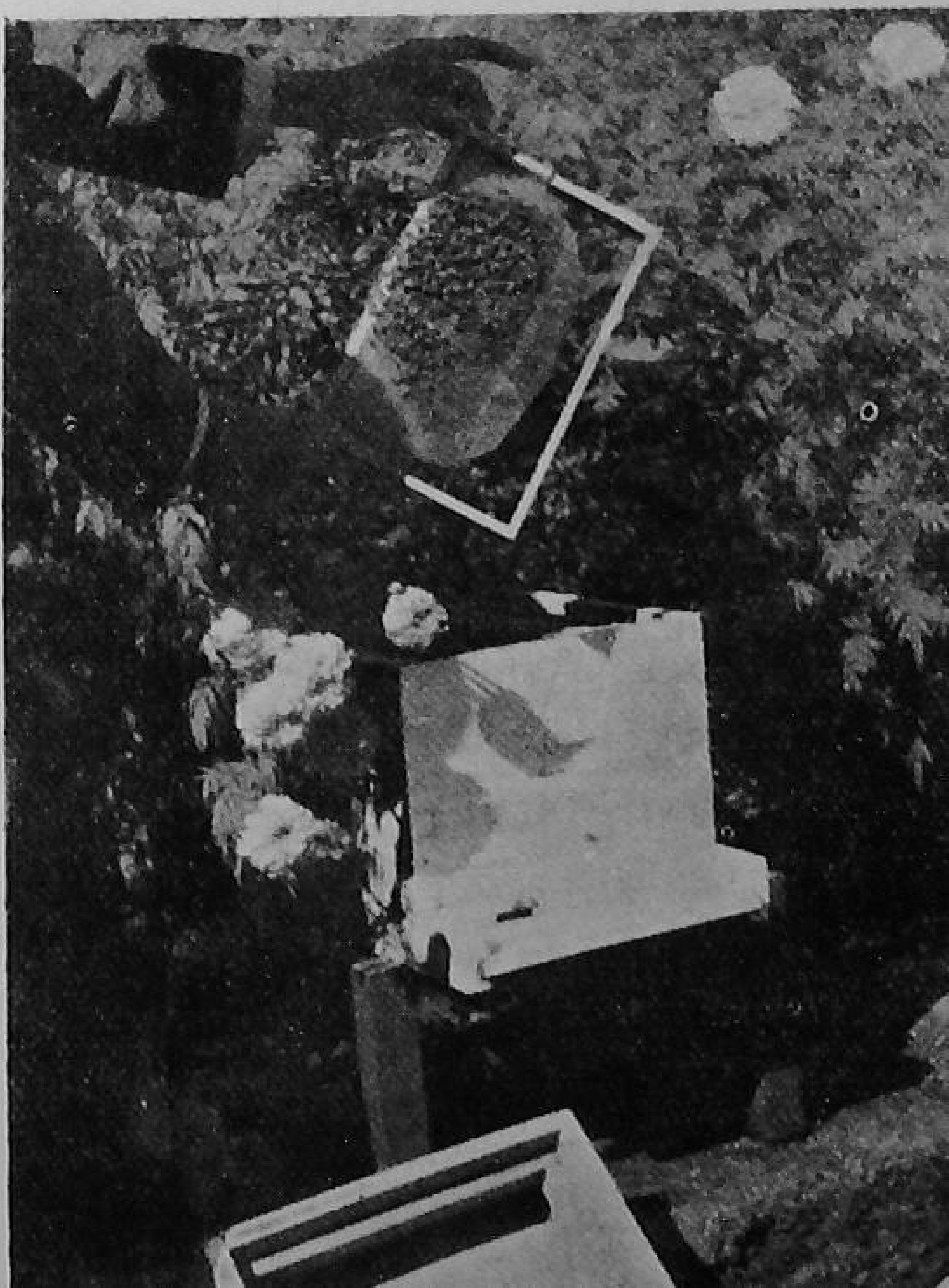
If the queen's eggs are present, there is generally no need to search for her. But, if for some reason, the queen must be seen, proceed to examine the frames one by one, commencing from one side. The side frames are generally full of honey. The queen is not likely to be there. When the brood, i.e., unsealed brood and eggs are seen, watch carefully for the queen and you will surely come by her. A colony in which you are anxious to find the queen should not be smoked, or smoked very lightly if at all, and dealt with very gently. In this way, you may see the queen actually at work and she may even go on laying eggs under your eyes, unmindful of you.

How to examine a colony : a comb has two sides ; first examine one side of the frame...



Food and feeding

In a hive with bees there should always be plenty of food. This is an important factor for success, and most failures, or poor results in bee-keeping are due to a disregard of this one factor. Each normal-sized colony should always have at least four to five pounds of honey in its combs. The bees should be fed when the



...then turn the comb, keeping it in vertical position, to see the other side

honey store falls below this level, and not when the bees are left with no honey at all.

Feeding is given to replenish the food reserve of a colony. For this purpose, a thick syrup made up of one part water and two parts sugar should be fed in rapid feeders.

Extra feeding is given to induce the bees to draw the comb foundation. For this purpose, a sugar syrup made up of equal quantities of water and sugar is given in a rapid feeder.

Feeding when given slowly and without interruption induces egg laying. When it is desired to stimulate brood rearing, feed a syrup made up of one part sugar and two parts water through a slow feeder without interruption for several days. However, when there is nectar flow outside, this practice will not be of much use.

Comb space

One of the first essentials of success in bee-keeping is that the bees should always have ample comb space to expand their brood nest. This extra space should be provided to them in advance of their need, as otherwise, the work of the colony will suffer. The additional space should be given by giving extra frames with drawn combs, or, in their absence, frames fitted with comb foundations. When the brood chamber is nearly full, put on the super.

Swarming

Another important principle for success is that the bees must be kept under one roof and not allowed to divide their strength by swarming. Swarming is a natural function, and the bee-keeper must always bear in mind that when he is trying to check swarming he is trying to check a normal, essential and natural function of the bee colony ; thus, if sometimes he does not succeed, it is not a matter for surprise or worry.

Swarming can be prevented or controlled by the following simple methods :

1. Always provide ample space for expansion of the brood nest in advance of the bees' requirements. If necessary, give an extra hive body.
2. There should be ample provision for sufficient ventilation in the hive.
3. Always have a young vigorous queen in the colony.
4. Protect the hive from the hot midday sun. Provide shade.
5. Keep the queen's wings clipped. When the queen cannot accompany the swarm, it returns to the hive. The queen has to be found by the bee-keeper and replaced in the hive, and the queen cells destroyed.
6. Examine the hive at least once a week during the swarming season.
7. If the brood chamber becomes overcrowded, remove some brood combs with the adhering bees and place empty drawn combs in their place. The brood combs and the young bees may either be given to some other weak colony, or placed in another hive body over the queen-excluder over the brood chamber.

If, in spite of all these measures, the bees swarm, hive them in a separate hive.

Introducing a queen

A strange queen is seldom accepted by the bees unless some precautions are taken. It is first necessary to make sure that :

1. There is no queen in the colony. If there is one, catch her and remove her.

2. There is no queen cell in the colony. If there are some carefully remove them all.
3. There are no laying workers in the colony. A colony with laying workers cannot generally be successfully re-queened. It is safer to unite the colony with a queen-right colony when the workers will destroy the laying workers. This colony can later be divided into two colonies and the queenless portion given a queen.

A safe way of introducing a queen is with the help of the queen-introducing cage, already described. Some direct ways, successful in 80 per cent cases, are given below. In handling a queen, she should always be held by the thorax or wings, never by the abdomen.

1. Dip the queen in water and then drop her gently over the frames of the colony in which she is to be introduced. Cover the hive.
2. Take a little honey from the combs of the colony in which the queen is to be introduced and smear a small quantity gently on the abdomen of the queen. Then let her enter the colony from the hive entrance or drop her over the frames of the brood chamber. The bees will lick her and accept her.
3. Puff a good deal of smoke inside the hive into which the queen is to be introduced. Then introduce the queen through the hive entrance.

Syrup for feeding

Boil the required quantity of water (see page 32), put the required amount of sugar in it and stir slowly. Keep on stirring to prevent sugar crystals at the bottom being burnt. When all the sugar is dissolved, remove from the fire and allow to cool till it is just warm. Then feed.

The feeding vessels should be carefully washed and kept clean so that the syrup does not ferment.

Robbing

Sometimes the bees of a colony or wild bees rob another colony of stores. Such a robbing can be detected by watching the behaviour of the bees at the entrance. Robbers try to slip in undetected like thieves from the corners of the entrance, and often seek other ways of getting into the hive than the entrance. The real inmates of the hive come straight to the entrance and behave normally and enter as of right. Also, such bees leaving a colony go out with empty stomach and fly straight out. A robber's abdomen is swollen with the thieved stores and she is heavy, and consequently, takes time to take to the wing.

As soon as robbing is detected, narrow the entrance of the robbed hive to one bee space and put some grass in front of it. This allows the bees better opportunity to guard themselves. In severe cases, the places of the robbed and robbing hives may be interchanged.

Robbing once started is difficult to stop and tends to spread to other hives in the apiary. The best way is to prevent it from being started. Some of the ways in which robbing gets started are given below :

1. Allowing the honey or the sugar syrup to remain open near the hives and within the approach of the bees
2. Spilling the honey or syrup near the hives
3. Resorting to feeding outside the hives in the open
4. Keeping weak colonies which cannot defend their stores
5. Feeding weak colonies during day-time
6. Keeping the bees in hives which are not bee-proof and have cracks

Requeening

A queen generally lives for two to three years or sometimes more. However, after one year, her power of egg laying declines. Also, colonies headed by old queens tend to swarm more. It is, therefore, a good practice to change the queen every year. This requeening is best done about two months before the commencement of the main honey flow in the locality. For requeening, take the queen cells or queens from a colony that has the best record of performance.

Shaking bees off the frames

It is sometimes necessary to shake the frames free of the adhering bees, as, for example, when the honey frames have to be removed for extraction. This is how you proceed. Place a large board, or a piece of newspaper, slantingly in front of the hive entrance. Then hold the frame tightly with the two hands and give it two or three quick jerks over the board or the newspaper sheet. All the bees will drop off and enter the hive.

Adding young bees to a colony

Sometimes, it is necessary to add young bees to a colony to strengthen it. Young bees are those who have not yet become foragers and who, therefore, do not yet recognize their own hive fully. Also, young bees are so innocent that they are commonly accepted by stranger colonies, that is, colonies other than their own, without objection.

The behaviour of the bees of one colony when placed in another colony, is an important factor, in their acceptance by the bees of the new colony. Young bees behave in a normal and natural way, as if they were in their own colony. Hence the bees of the new colony accept them without any suspicion being aroused in them.

To add young bees to a colony, place a board or a

newspaper sheet in front of the entrance. Take a brood frame with all the adhering bees from a colony from which the young bees have to be taken, and after examining it to make sure that the queen is not on the frame, shake off the bees on to the board or the newspaper sheet. The foragers will quickly fly back to their own hives but the young bees will enter the hive before which they have been dropped.

Making a colony strong

The main principle governing the maximum production of honey by any colony is that it should be at the peak of its strength at the commencement of the main honey flow in the locality, and should stay strong throughout the period of the flow. It is, therefore, of utmost importance that the colony is made strong in time. The following are the requirements for making a colony strong :

1. A young, vigorous and prolific queen in the colony
2. A sufficient number of bees in the colony to cover the combs in which the queen lays eggs
3. A sufficient number of young bees in the colony to feed and nurse the larvae hatched from eggs laid by the queen
4. Availability of a nectar flow, and when there is not, artificial feeding in adequate quantities
5. Availability of sufficient comb space for egg laying by the queen
6. A sufficiently warm season to enable the bees to rear the brood

The bee-keeper has to examine his colonies and see that these requirements are fully met. Stimulative feeding should be started eight weeks before the commencement of the main honey flow of

the locality. If the weather is cold, ample protection should be provided.

Maintaining the strength of colonies

To maintain the strength of colonies, it is necessary that :

1. Ample stores are ensured at all times
2. The presence of a vigorous queen is ensured at all times
3. Queenlessness is prevented
4. Swarming is prevented
5. Adequate protection is given so that the bees, though strong in numbers, do not become exhausted and weak by the labour involved in maintaining the appropriate hive temperature

Uniting

Sometimes it is necessary to unite two colonies into one. In such cases, do not unite two weak colonies. It is better to unite a weak colony with a medium-sized colony.

First, if one of the queens in the two colonies is known to be the better, the other should be found and removed ; otherwise, the two queens may be left to settle the matter among themselves.

A safe way to unite two colonies to bring them near each other is by moving them towards each other gradually, at the rate of one or two feet per day. When about two or three feet from each other, place one colony in the centre of the last two locations, remove its roof and place a single sheet of newspaper over the frames of the brood chamber, so that it completely covers the brood chamber. Prick small holes in the newspaper with a match stick and sprinkle some very thin sugar syrup over the paper. Now lift the other hive from its bottom board and place it over the brood chamber of the other hive, with the newspaper sheet in-between the two. Then leave them alone for about two days.

During this period, the bees will have cut through the paper and become peacefully united. If the colony placed on the top does not have sufficient food, this should be provided. Ventilation should also be ample. When united, place all the covered frames in the lower brood chamber.

Dividing

To make two or more colonies out of one strong colony, place a hive fitted with frames of drawn combs, or fitted with comb foundations, about two feet to the right, and with its face to the same side as of the hive to be divided. Remove the roof and take out half the frames from it. Shift the hive to be divided two feet to the left of its original location, so that now there is a distance of four feet between the two hives.

Remove the roof and carefully take out from it one frame of honey with the adhering bees, one frame of brood with the adhering bees and the queen and one frame of sealed brood, and place these in the empty space in the other hive.

Place three empty frames, with drawn combs or fitted with comb foundations, in the place of the frames removed. Introduce a queen or queen cell to the hive rendered queenless. If neither a queen nor a queen cell is available, make sure that the hive rendered queenless has some worker eggs. Now close the hives. The foragers will divide themselves between the two hives fairly equally. Every day, shift both the hives one foot away from their locations, till the two hives are more than six feet apart. Now leave them alone but keep a watch for robbers. Examine after 10 or 12 days to ensure that the queenless hive has a queen.

Effect of bee sting

Normal individuals are not much affected by bee stings and after the first few stings acquire partial immunity from the undesirable effects of the sting. Those who are abnormally

susceptible to them, however, should keep away from bees and bee-keeping.

When stung, the first thing is to remain calm. Remove the sting with the edge of a knife or other similar article. The sting has a poison sac attached to it and this goes on injecting poison into the body even after it is detached from the body of the bee. If this sting be caught from its detached end and pulled, the pressure injects more poison into the body. Therefore, it is necessary to remove the sting immediately after it has been inflicted and to remove it in such a manner that the poison sac attached to it is not pressed. Afterwards, rub some green leaf on the affected part to remove the odour of bee sting.

Transporting bees

First, carefully move all self-spacing frames to one side of the brood chamber and press them tight. Then put one nail against either end of the last frame so that it keeps all the frames in position, tightly pressed against one another. Join the floor board with the brood chamber by nailing four pieces of iron strips at the four corners. Similarly, fasten the hive entrance rod securely to the bottom board and the brood chamber. Close the top by nailing wire gauze or a thick meshed strong cloth all over it. See that the hive is bee-tight.

After dark, when all the bees are in, close the hive entrance with a piece of wire gauze. The hive is now ready to be moved to any place. If the bees have to be kept confined for more than a day, some water should be sprinkled daily over the top of the wire gauze or the cloth cover. The roof should not be replaced when the hives are on the move because the bees thus confined need a lot of ventilation. Water is needed for feeding the young lorvae. Colonies to be moved over a long distance involving a journey for several days should have sufficient stores of honey, but little unsealed brood and eggs.

On arrival at the destination, the hive should be placed where it is to remain and the entrance should be opened a couple of hours before dark.

Locality and its importance

A primary requirement for the production of good yields of surplus honey by colonies is that there should be, in the vicinity of the apiary and preferably within a radius of one mile from it, sufficient flora to provide ample quantities of nectar and pollen to the bees.

Tree sources are the most dependable ones as they yield nectar even when there is no irrigation and the rains fail. There are, in every locality, what are known as major sources of nectar. These bloom in large quantities at particular seasons of the year and provide abundant nectar to the bees. From such sources the bees gather and store surplus honey which the bee-keeper removes from the supers as his own share.

Besides the major sources, the colony requires minor sources to provide it with food for its own subsistence throughout the year. These may be weeds, bushes, cultivated field crops, vegetables or fruit trees.

Migratory bee-keeping

The small-scale bee-keeper has perforce to keep his bees where he lives. He has no choice of finding out a suitable locality. The professional or commercial bee-keeper has to search for a good locality. Also, he can shift his colonies from one locality to another, in different seasons, according to honey flow prospects. Occasionally, it may be possible even for the small-scale bee-keeper to temporarily shift his colonies to a good locality to take advantage of the honey flow there. This is called migratory bee-keeping. It is a profitable practice.

Seasonal management

Management practices depend on flora and weather conditions. These differ in different localities, and in the same locality at different seasons. As the seasons are of different intensity and also differ in the period of their commencement and duration in different localities, no hard and fast practices according to fixed dates can be laid down. Only general directions can be given which the bee-keeper has to adapt according to conditions prevailing in his locality at different times.

Availability of sufficient nectar-yielding flora within reach of the bees and favourable weather conditions which permit the bees to fly out and collect their food for a sufficiently long period each day, are the main factors to be remembered.

Management during winter. In the plains, where it is not severe, the winter is often a busy period for the bees. It is during the winter months (from November to January), for example, that the mustard and allied crops are in bloom in the plains providing abundant nectar to the bees and enabling them to collect sufficient quantities of surplus honey.

On the hills, where the winter is severe, the bees should be given ample protection throughout. Before the first severe frost occurs, they should be properly packed for the winter. One good way of doing this is to cover the whole hive including the top and bottom and all the six sides, with dry grass and to tie the same with strings. Keep a hole open in front of the entrance to allow the bees to fly out. Now cover the grass packing with inter-twined leaves to save the hive from becoming wet during rain or snow. This form of packing costs little.

Before packing a hive thus for the winter, ensure

1. that each colony has a young queen;

2. that each colony has a sufficient number of bees. (Weak colonies should not be packed separately but should be united with strong colonies) ;

3. that each colony has sufficient stores of food inside it to carry it through the winter months. (The actual quantity of food needed depends on the severity and length of the winter in the locality) ;

4. that the hive is dry, free from cracks and the roof leak-proof.

The hives should be well protected from cold winter winds. A windbreak should be provided.

Management during spring. Spring is the most important period for the bees and the bee-keeper, both in the plains and on the hills. The requirements in spring are :

1. Where the bees have been packed, they should not be unpacked till the warm weather sets in. Any colony which may be behaving doubtfully at the entrance, may be temporarily unpacked during a warm sunny day, quickly examined for queen-rightness and food sufficiency and then quickly closed.

2. After unpacking, examine the colonies carefully for queen-rightness and start giving stimulative feeding, or starvation feeding (feeding when the bees are without any reserve of food in the comb s), according to the needs of individual colonies. Clean the hive carefully.

3. During spring, much brood is reared for which the bees need plenty of water. Facilities for drinking water should be provided very near the hives.

4. Colonies weak in bees may be given some sealed brood from a strong colony which can spare it. Very weak

colonies should be united with strong colonies. The bee-keeper must remember that a weak colony is a liability, while a strong colony is an asset. Therefore, he should place importance not on the *number* of his colonies but on the *strength* of his colonies.

5. Provide comb space wherever needed.

Management during summer. Summer provides no problem on the hills. But in the plains of North India, where the heat is very severe and hot winds blow, summer is the difficult part of the year for the bees. The heat and lack of humidity have adverse effects on the bees and their activities. The following steps are, therefore, recommended during the hot part of the year :

1. Keep the hive in deep shade. If the natural shade of trees is not available, provide shade by artificial means.

2. Feed a watery sugar solution (one part sugar to seven or eight parts of water), in a rapid feeder and within the hive every day. This will maintain suitable humidity conditions within the hive for brood rearing.

3. Sprinkle water over and near the hive every morning and evening.

4. Use windbreaks to protect the colony from hot winds.

Management during the monsoon. This is generally the difficult period on the hills. The bees remain mostly inactive because of constant rain. The brood-rearing activity dwindles and the colony becomes weak. The wax-moth activity is at its height during this period and the bee-keeper has to maintain a constant watch against the wax-moth and other enemies. On the hills, wasps turn out to be the most serious pest at this time.

Management during autumn. This is a favourable period in some localities, and surplus honey is produced. In some places, this is the season when the main honey crop is produced. The requirements are : strong, queen-right colonies at the commencement of the honey flow. Colonies should be prepared during this period for winter packing in the hills.

Handling honey

The frames should be removed from the hive for extraction when all the cells in them are sealed. But in practice, this is not always possible. Hence, the frames may be removed when two-thirds or three-fourths of the cells are sealed. Cappings are then removed by passing a warmed uncapping knife over the comb surface. Remove the cappings on both sides of the combs and place the combs in the honey extractor for extracting the honey.

Strain the honey through a piece of cloth, preferably twice. Fill it in clean glass bottles. The honey which is not to be consumed within the next few days has to be processed. Otherwise it will ferment and become unfit for human consumption.

Honey absorbs moisture from air. Thereafter, it is liable to ferment. It should not, therefore, be stored in porous receptacles such as earthen pots.

Honey is slightly acid. Hence, utensils of iron, brass, copper, etc., are not fit for storing honey. Heavily tinned vessels, glass jars, glazed pottery, Chinaware and waxed paper are safe for storing honey.

Honey meant for keeping long after extraction must be pasteurized and then kept in air-tight containers. For pasteurizing honey, heat it up to 160°F and maintain this temperature for 15 to 30 minutes. Then rapidly cool to the atmospheric temperature. Store in air-tight containers, preferably wide-mouthed, which have

been sterilized beforehand and dried. Boiling the containers in water is a good method of sterilizing them.

Wide-mouthed receptacles for storing honey are recommended for two reasons. Honey is a liquid, but under certain conditions it is liable to granulate and become semi-solid. In such cases, it has to be heated every time if it has to be taken out of a narrow-mouthed receptacle. But if the bottle is wide-mouthed, the honey can be taken out with a spoon even if it is granulated.

Honey should never be heated over direct heat. The container containing the honey should be placed in hot water and the water heated.

Honey should not be heated to a temperature beyond 160°F, otherwise, it becomes discoloured and spoiled.

Beeswax : its collection and care

Keep a tin or wooden box, which can be closed tightly so as to be wax-moth proof. Keep a few naphthalene balls inside it. Collect all bits of wax, cappings, scrapings from the frames or bits of old combs and burr combs, i.e., bits of combs made irregularly and in addition to the normal combs met with during your work with the bees, and put them in this box. When a sufficient quantity has been collected, tie or better still, sew it in a piece of gunny bag and put it in a tin 2/3rd full of water. The bundle will float. Push it down to the bottom of the tin and place a heavy piece of stone over it to keep it there. Let it remain this way overnight. Next day, boil it over the fire for about half an hour. Then pour the hot liquid into another empty tin, straining it through a piece of cloth. The wax will float on top of the water and, when the water cools down, the wax at the top will solidify into a cake and can then be removed.

Beeswax should not be allowed to come in contact with zinc, iron or other metallic substances. Best materials in which

it may be boiled or kept are : tinned vessels, glass or earthenware. Otherwise, the beeswax loses its characteristic colour and smell.

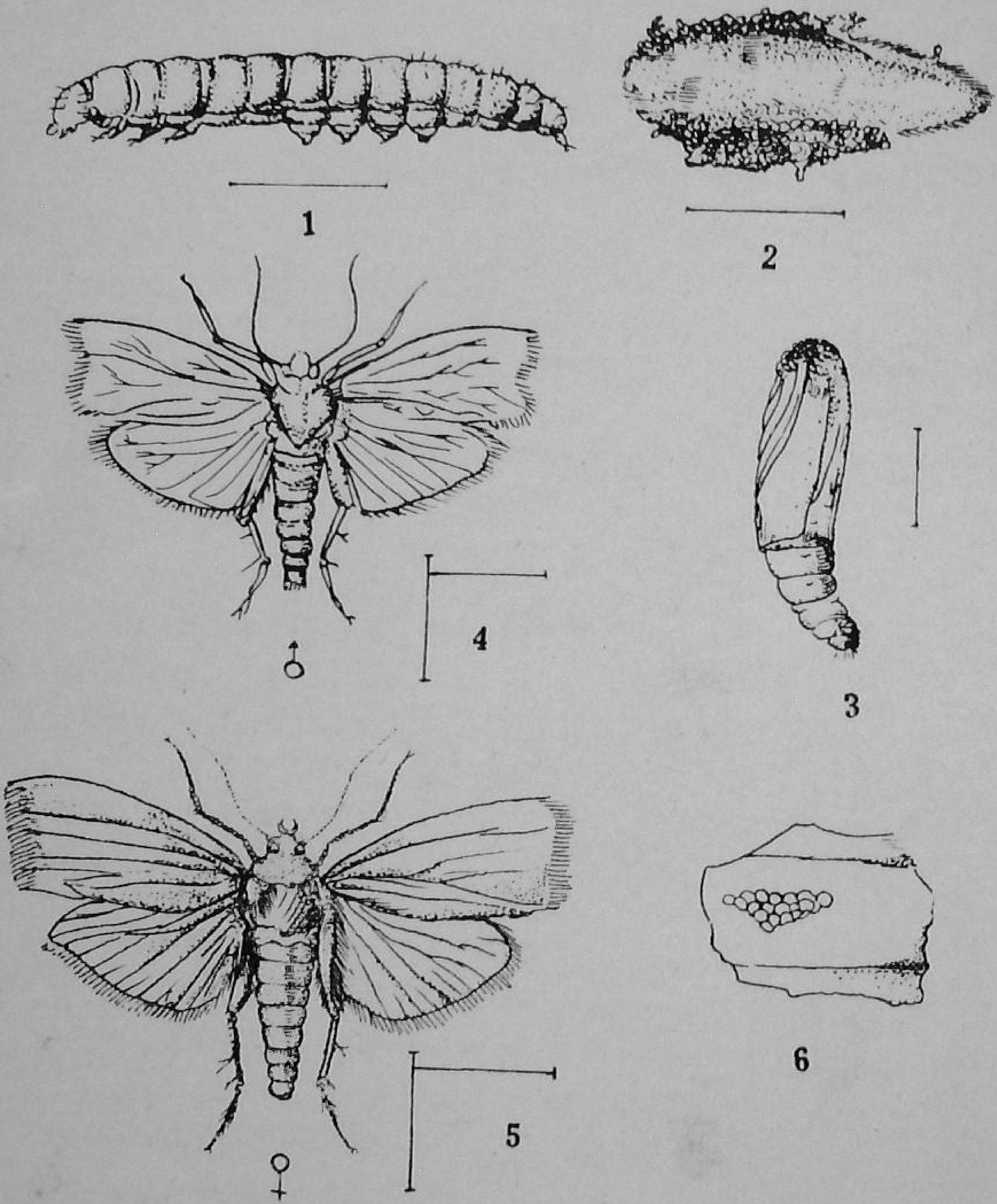
ENEMIES AND DISEASES OF BEES

IN the plains, the biggest enemies of bees are the greater wax moth and the lesser wax moth. The female of the moth lays eggs inside the hive on uncovered portions of the comb or in the cracks in the walls or roof or bottom board of the hive. These eggs hatch and the larvae make tunnels in the combs, eating their way through the combs and weaving a silken web around them. If not controlled in time, the bees run away from the hive.

To check and control this pest, the following measures are recommended :

1. Examine the colonies frequently during the period of wax-moth activity and watch for eggs and larvae. Destroy the eggs, if found. If larvae are found, expose the frame for a short time to the sun taking care not to keep them too long; otherwise, the comb may melt and get damaged. The heat makes them uncomfortable and most of them fall down from the frames. Introduce this infected comb in the middle of a strong colony. The bees will clear the frame. Examine daily and repeat the operation till all the combs are cleared of the waxworms.
2. Keep the colonies strong. A strong colony does not tolerate the moth eggs or larvae.
3. Do not keep more combs in the hive than the bees can fully cover.
4. Do not keep bits of wax or combs exposed. This enables the moth to breed.

THE WAX MOTH



1. Full-grown caterpillar 2. Cocoon 3. Pupa 4. Male moth 5. Female moth 6. A cluster of eggs (all magnified)

5. Render all combs badly infected by the moth larvae into beeswax.

6. Keep drawn combs not in use in a moth-tight box and fumigate with sulphur fumes every two weeks.

Wasps. On the hills, there are some kinds of big wasps. These hover round the entrance of the beehives and catch and devour incoming bees. Sometimes they enter the hive too.

A strong colony of bees would put up a brave defence, several of them catching a big wasp and stinging it to death, but the wasps may come in great force and then the bees become demoralized and the wasps attack in large numbers, often completely destroying the colony. The following will be the remedies :

1. Find out and burn at night all natural nests of these wasps within two or three miles of your bees.

2. In early spring, destroy all wasps found on the wing. These are the queen wasps, and each one of them is capable of establishing a wasp colony.

3. Watch the entrances of your hives and destroy the wasps worrying your bees.

Ants. Several species of ants, both black and red, often attack colonies. The usual mode of protection is to keep the hives on a stand, the legs of which stand in pots or tins containing water.

There are several other enemies like the birds, pine martens, frogs, lizzards and dragon flies. But these do but occasional damage.

Diseases of bees

The varieties of honey-bees kept in Europe and the U.S.A. are susceptible to several very deadly and contagious diseases. This is one strong reason why these bees should not be imported

into India. Our bees are disease-free. The only ailments known are paralysis and dysentery.

In paralysis, the bees are unable to fly and crawl about and often die in front of their hives. Affected bees present a shiny, hairless appearance with the abdomens swollen, and other bees of the colony often attack them and thrust them out. In such cases, dust the combs (other than those containing the brood) with powdered sulphur, and change the queen.

Dysentery can hardly be termed a disease. It may be caused by an exposure to cold or by improper food. The bees excrete a yellowish liquid all over the hive and often inside it. A flight on a sunny day, however, cures the condition.

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